

agriculture and the food supply

The supply of food depends on three factors: how much has been produced by agriculture and fishing (see **FISHING INDUSTRY**), how much has been consumed, and how much has been preserved by safe processing and storage. The most important agricultural products for the world's food supply are cereals (**GRAIN**), pulse crops (see **PULSE CROP**), and, to a lesser extent, livestock (see **ANIMAL HUSBANDRY**). Cereals, such as wheat, rice, maize (corn), millet, and sorghum, provide nearly all the food energy (calories) and up to 90 percent of all protein consumed by the world's people. Pigs are the chief meat animal worldwide, followed by poultry, beef cattle, and sheep. Pulses—the seed parts of such legumes as beans, soybeans, and peanuts (groundnuts)—are important sources of protein in the world food supply. Except for sugar and bananas, few of the other crops that are prominent in the world agriculture trade have nutritional significance in the food supply. Many fruits, grains, and vegetables that are unfamiliar to Western agriculture, however, serve as important local food supplies.

Supply and Population

About 90 percent of all grain produced is consumed in the countries where it is grown. The 10 percent that enters world trade comes from the few countries—the United States, Canada, Australia, and Argentina—where the grain produced far exceeds domestic needs. Most countries depend to some extent—and developing countries tend to depend heavily—on cereal imports to augment their own crops.

Some authorities predict that population growth will eventually surpass world food production and that massive famine will result—a theory first proposed by the British social philosopher Thomas **MALTHUS**. Other authorities, who point to a recent decrease of population growth rates as well as to dramatic gains in agricultural production, insist that such a tragedy can be prevented by a combination of appropriate governmental policies and appropriate research and technology.

Effective Demand

Both high population growth and the effects of a minority of the world's people having the money to consume more than they need can cause stresses in the food supply. Persistent poverty, however, is the underlying cause of the world's hunger problem because in many places the ability to obtain food is determined by income and purchasing power no matter how large the supply may be. People or governments without enough purchasing power lack what is called effective demand for food in the marketplace.

Many governments find it necessary, therefore, to protect the nutritional needs of their own low-income populations, and sometimes those of others, with special programs. The most extensive food-aid program undertaken is the Food for Peace program conducted since 1954 by the U.S. government. Through this program, U.S. surplus grain either can be sold to developing countries at normal market prices with the aid of low-interest loans or can be distributed at no charge by such organizations as Catholic Relief Services or Cooperative for American Relief Everywhere (see **CARE**) to developing countries faced with food emergencies.

Sometimes the laws of effective demand hurt the poor in unexpected ways when traditional agriculture in developing countries is modernized and brought into the international market system. When India's farmers, for example, began to find wheat and rice production more profitable than before the **GREEN REVOLUTION**, they lost interest in traditional pulse production. As pulses became less plentiful in the local markets, their prices rose. Malnutrition increased because the poorest could no longer afford to balance their incomplete grain-protein diet with pulses.

FACTORS AFFECTING FOOD SUPPLY

Basic farming practices (see **FARMS AND FARMING**)—planting, harvesting, and storage of crops—are generally similar everywhere, but various systems of farming exist. In many developing nations much of the cropland is currently devoted to subsistence agriculture, a food-production system characterized by minimal mechanization, high reliance on human labor, and mostly on-farm consumption of what is grown. About 60 percent of the world's cropland is estimated to be in subsistence agriculture. Another form of food production, particularly in North America, Europe, Central America, and Oceania, is commercial agriculture, which is large-scale, highly mechanized, and entirely market-oriented (see **AGRIBUSINESS**). **COLLECTIVE FARMS** and communes—once characteristic of the centrally planned countries of eastern Europe and China—were very large, state-run enterprises designed to provide food for the nation as a whole. By the mid-1990s the Chinese government had ceded much of its control over agriculture back to the countryside and had begun to allow its peasants to own land.

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Supply and Population

About 90 percent of all grain produced is consumed in the countries where it is grown. The 10 percent that enters world trade comes from the four countries—the United States, Canada, Australia, and Argentina—where the grain produced far exceeds domestic needs. Most countries depend on some form of grain and developing countries tend to depend heavily on cereal imports to augment their own crops.

Some authorities predict that by 2050 the world will eventually produce enough food to feed the world's population. This prediction is based on the fact that the world's population is growing rapidly and that the world's food supply is increasing. However, it is also true that the world's population is growing rapidly and that the world's food supply is increasing. However, it is also true that the world's population is growing rapidly and that the world's food supply is increasing. However, it is also true that the world's population is growing rapidly and that the world's food supply is increasing.

Effective Demand

Both high population growth and the effects of a minority of the world's people having the money to consume more than they need can cause shortages in the food supply. Persistent poverty, however, is the underlying cause of the world's hunger problem because in many places the ability to obtain food is determined by income and purchasing power. No matter how large the supply may be, people or governments without enough purchasing power lack what is called effective demand for food in the marketplace.

Many governments find it necessary, therefore, to protect the nutritional needs of their own low-income populations and sometimes those of others, with special programs. The most extensive food-aid program in operation is the Food for Peace program conducted since 1954 by the U.S. government. Through this program, U.S. surplus grain either can be sold to developing countries at normal market prices with the aid of government loans or can be distributed at the charge by such organizations as Catholic Relief Services or Christian Relief for American Relief Overseas (see CARE) to developing countries faced with food emergencies.

Sometimes the laws of effective demand put the poor in unexpected ways with a nutritional problem in developing countries. When brought into the international market system, when India's farmers, for example, began to find wheat and rice production more profitable than before the GREEN REVOLUTION, they lost interest in traditional pulse production. As pulses became less profitable in the local market, their price rose. Nutritionists expressed concern because the pulses could no longer afford to balance their incomplete (protein-rich) diet with pulses.

FACTORS AFFECTING FOOD SUPPLY

Basic farming practices (see FARMING AND FARMING) are changing, however, and storage of crops are generally similar everywhere, but various systems of farming exist. In many developing nations much of the crop is currently devoted to subsistence agriculture, a self-production system of exchange by informal mechanisms. High reliance on human labor and mostly on farm consumption in what is grain. About 80 percent of the world's population is engaged in agriculture. A number of food production, particularly in Asia, Africa, Europe, Central America, and Oceania, is concentrated in large-scale, highly mechanized, and entirely market-oriented (see AGRICULTURE). COLLECTIVE FARMING and co-ops—once characteristic of the country's peasant farmers and their very large, state-run enterprises designed to provide food for the nation as a whole. By the mid-1980s the Chinese government had made much of its control over agriculture back to the countryside and had begun to allow its peasants to own land.

In the republics of the former USSR, however, the transformation of collectivized agriculture into a more market-dominated system was proving to be a slow and painful process.

Arable Land

Agriculture depends ultimately on arable land—land that has the potential to produce a crop. Some 3.2 billion ha (7.9 billion acres) of arable land exist worldwide, which is about 24 percent of the total ice-free land. Currently, less than half of the Earth's arable land is actually under cultivation. The largest reserves of unused arable land are located in Africa, where 72 percent of the arable land is not used for crops. Huge investments would be necessary to do the clearing, leveling, disease control, and irrigating required for much of this land to become fully productive.

As demand for food has increased, land and SOIL mismanagement has occurred with alarming frequency. In the past 100 years in parts of the American Midwest, more than 50 percent of the topsoil has been lost to wind and water EROSION through improper cropping and tillage practices. About 1 million ha (2.5 million acres) of cropland are lost each year in the developing nations, due mostly to poor land management. Over grazing and deforestation of land have occurred in such areas as Mexico, Malaysia, and the Sahel. Arable land may be turned to DESERT by the combined effects of destroyed vegetation and erosion.

Arable land in urban and suburban areas worldwide has also been lost by conversion for housing and business purposes. Such loss of prime agricultural land in North America—more than 600,000 ha (1,482,600 acres) a year—is especially serious, and this land can only be replaced by bringing less productive, or more erosion-prone, land under cultivation. Efforts are now being made by a number of states in the United States and also by governments of other wealthy nations to preserve their best remaining agricultural land.

Water Supply

Many experts now believe that in the remaining years of the 20th century lack of water (see WATER RESOURCES) rather than lack of arable land will be the major obstacle to expanded worldwide food production. As with land, the amount of water available for agricultural use cannot easily be increased, but it can be better used. Research is now being done in the areas of IRRIGATION and seawater DESALINATION to improve water availability and thus increase the amount of land that can be farmed.

Climate and Weather

Climate, the long-term atmospheric conditions of a region, determines the cropping possibilities in an area. Rice grows in a wet, tropical climate, for instance, and corn grows in a humid subtropical or temperate climate. Weather is the daily expression of climate and can change greatly from day to day or seasonally. Weather patterns may occasionally set limits on agricultural productivity, even in generally favorable climates. Famines in India and China can be traced to such erratic weather patterns as high (causing floods) and low (causing droughts) precipitation in climate zones that otherwise would be expected to produce successful crop yields. Climates, although relatively stable, also change. In the Northern Hemisphere, for example, climatic patterns appear to be becoming more extreme, which may cause serious agricultural disruption.

Fertilizer

Because soils often lack the right kind and amount of plant nutrients for the best crop results, the farmer must supply such missing nutrients. In many parts of the world, fertility needs are met by the use of inorganic chemical FERTILIZER. For developing nations, however, the cost of such fertilizer is often too high. Less than 20 percent of the world's inorganic fertilizer supply is used in these countries. Organic sources of plant nutrients are widely used to increase soil fertility in the developing nations where inorganic chemical fertilizers are scarce or too costly.

Pests

Once a crop has been established, the farmer is immediately threatened with crop losses from a variety of pests. Annual losses due to pests amount to 20 percent–40 percent of potential production, and the crops destroyed by pests each year are worth about \$30–80 billion worldwide. In developed nations, pests have been controlled by chemical PESTICIDES and HERBICIDES. Chemical pesticides, however, can cause ecological damage and present hazards to human health. Increasingly, chemical pesticides and their hazardous potential are being introduced into developing regions of the world. Appropriate pest-control strategies, however, can replace the exclusive use of chemicals; they include a combination of crop breeding for genetic resistance to specific pest

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Arable Land

Agriculture depends ultimately on arable land—land that has the potential to produce a crop. Some 5.2 billion ha (12.8 billion acres) of arable land exist worldwide, which is about 12 percent of the total ice-free land. Currently less than half of the Earth's arable land is actually under cultivation. The unused reserves of unused arable land are located in Africa, where 12 percent of the world's land is not used for crops. Huge investments would be necessary to do the clearing, leveling, drainage control, and irrigation needed for much of this land to become fully productive.

As demand for food has increased, land use has increased. Land and 30% of the world's population live in the arable land. In 1900, 100 years in part of the American Midwest, more than 30 percent of the land was used for crops and water. 250,000 ha (625,000 acres) of land were lost each year in the developing regions, due mostly to poor land management. Over grazing and deforestation of land have occurred in such areas as Africa, Asia, and the Soviet Union. Arable land may be limited to 1985 by the combined effects of destroyed vegetation and erosion.

Arable land in urban and suburban areas worldwide has also been lost by conversion for housing and business purposes. Such loss of prime agricultural land in North America—more than 300,000 ha (748,300 acres) a year—is especially critical, and has not only been replaced by building lots, parking lots, or more extensive land under cultivation. Efforts are now being made by a number of states in the United States and also by governments of other wealthy nations to preserve their best remaining agricultural land.

Water Supply

Many experts now believe that in the coming years of the 21st century lack of water will be a major problem. (RESEARCH) rather than lack of arable land will be the major obstacle to expanded worldwide food production. As with land, the amount of water available for agriculture has cannot easily be increased, but it can be better used. Research is now being done in the areas of RESEARCH and CONSERVATION to improve water availability and thus increase the amount of land that can be farmed.

Climate and Weather

Climate, the long-term atmospheric conditions of a region, determines the growing possibilities in an area. It grows in a wet, tropical climate, for instance, and corn grows in a humid subtropical or temperate climate. Weather is the daily expression of climate and can change greatly from day to day or seasonally. Weather patterns may occasionally set limits on agricultural production, even in generally favorable climates. Farmers in India and China can be forced to such erratic weather patterns as high (causing floods) and low (causing droughts) precipitation in their areas. The climate would be expected to produce successful crop yields. Climate is changing through relatively stable, also change in the Northern Hemisphere, for example, climatic patterns appear to be becoming more extreme, which may cause serious agricultural disruption.

Fertilizer

For some soils often lack the right kind and amount of plant nutrients for the best crop results, the farmer must supply such missing nutrients. In many parts of the world, fertilizers are made by the use of inorganic chemicals. For developing nations, however, the cost of such fertilizers is often too high. Less than 30 percent of the world's inorganic fertilizer supply is used in these countries. Organic sources of plant nutrients are widely used to increase soil fertility in the developing nations where inorganic chemical fertilizers are scarce or too costly.

Pests

Once a crop has been established, the farmer is immediately threatened with crop losses from a variety of pests. Annual losses due to pests amount to 30 percent of the world's food production, and the crops destroyed by pests each year are worth about 100-200 billion worldwide. In the United States, pests have been controlled by chemical PESTICIDES and HERBICIDES. Chemical pesticides, however, can cause ecological damage and present hazards to human health. Increasingly, chemical pesticides and their hazardous potential are being introduced into developing regions of the world. Agricultural pest-control strategies, however, can replace the current use of chemicals. They include a combination of crop breeding for genetic resistance to specific pests.